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SYSTEMS ENGINEERING MANAGEMENT PLAN FOR THE EG&G ROCKY FLATS PLANT

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ENVIRONMENTAL RESTORATION MANAGEMENT PROGRAM

Prepared for the
U S DEPARTMENT OF ENERGY
Office of Environmental Restoration and Waste Management Under DOE Contract No

EG&G Rocky Flats Plant

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Approved by

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1 0 INTRODUCTION

The Systems Engineering Management Plan (SEMP) describes the systematic and rigorous approach used by EG&G at the Rocky Flats Plant (RFP) in the application of systems engineering to the Environmental Restoration Management (ERM) Program. Included is a definition of the systems engineering process and the method used for planning and control the systems engineering process, and engineering specialty integration

In this document, the term systems engineering or systems engineering management is used when discussing activities or functions that may be performed by several EG&G ERM Program organizational elements (i e operable units (OUs) The term systems engineering or systems engineering management as used herein refers to the conduct of technical activities rather than specific organizations engineering disciplines or Contract Work Breakdown Structure (CWBS) elements

The EG&G ERM Program Manager exercises overall direction and control of systems engineering efforts through development of project management plans setting and enforcing project goals and timetables memoranda, and review meetings

1 1 REFERENCES

The systems engineering approach given in this document is based on the requirements and guidance provided in Department of Energy (DOE) Order 4700 1 The references used in the preparation of this plan are included in Section 5 0

1 2 POLICY

This document presents guidance for using systems engineering to accomplish the EG&G ERM Program s technical objectives. By issuing this document, the EG&G ERM Program requires the use of systems engineering from all other EG&G organizations supporting the ER Program.

The policies and scope of systems engineering presented herein cover a broad range of ERM Program activities For cost effectiveness, systems engineering will be tailored to match the need and scope of the individual OU projects

When this document does not clearly define the systems engineering approach for an given activity the EG&G ERM Program Manager may establish the requirements of the systems engineering approach for such an activity on an as needed basis.

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Implementation of systems engineering will integrate the requirements given in DOE Order 4700 1 the Federal Facilities Agreement and Consent Order Interagency Agreement (IAG) and Environmental Protection Agency (EPA) guidelines for conducting environmental restoration activities (See References 1 and 2) The goal is to eliminate duplication of systems-engineering related efforts required by these three documents while ensuring compliance with the program mission and objectives The integration of National Environmental Policy Act/Comprehensive Environmental Response Compensation and Liability Act (NEPA/CERCLA) requirements with system engineering is addressed in References 6 and 7 NEPA requirements which apply to NEPA/CERCLA integration are also discussed in Reference 7

All documents generated by the systems engineering process will be controlled in accordance with the EG&G Procedure Number 06 01 Rev 0 June 30 1993 Document Control

1 3 OBJECTIVES

The objectives of this SEMP are to

Ensure the systematic planning and control of an integrated ER Program engineering effort,

Provide a means to measure progress in achieving technical requirements including early identification of problems and high risk areas

Ensure the integration of engineering specialties (i e. maintainability environmental, health, and safety) into the total design effort; and

Integrate related technical parameters and ensure compatibility of interfaces including major system elements facilities utilities hardware software and procedures

1 4 SCOPE

The EG&G ERM Program focuses on site assessment, primarily site characterization and remedial alternatives evaluation/selection under the IAG Program activities also include the preparation of closure plans At the direction of DOE/Rocky Flats Office s (RFO's) Transition and Environmental Restoration Management Office the EG&G ERM Program may also provide remedial design (RD) and remedial action (RA) services for sites requiring interim action (IA) EG&G may also have RD/RA integration, revision and support responsibilities when RD and RA tasks are performed by other contractors Given this broad scope the technical activities of the EG&G ERM Program fall under the general category of site investigations/characterization, remedial alternatives evaluation/selection RD and RA. This SEMP is provided to direct and control these technical activities

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1 5 DEFINITIONS

1 5 1 Systems Engineering Management

The management and control approach to systems engineering of projects consists of three separate but related, activities (1) technical planning and control, (2) the systems engineering process and (3) engineering specialty integration as described in the following paragraphs

1 5 1 1 Technical Planning and Control Technical planning and control consists of the management and control of a project's technical components through use of a CWBS Cost Account Plans (CAPs) Work Packages, Planning Packages Integrated Work Control Packages (IWCP) configuration management, technical reviews, project management plans, and similar documents

1 5 1.2 The Systems Engineering Process The systems engineering process is a sequence of activities and decisions that transforms a mission need into a description of system performance parameters and preferred system configuration. The process is applied to ensure that the project s end result meets the defined need (i e all physical and functional interfaces are fulfilled) in a technically acceptable and cost-effective manner Accordingly the system configuration may be derived through an iterative process that examines alternative approaches developed by synthesis analysis, design and test, as applicable (some system configurations can be determined from a priori knowledge) Systems engineering integrates relevant technical parameters and ensures that all physical and functional interfaces meet defined requirements. Also systems engineering provides assurance that all applicable special engineering requirements, such as safety reliability availability operability maintainability and human factors have been appropriately factored into a cost-effective system configuration.

1.5 1.3 Engineering Specialty Integration Engineering specialty integration consists of the managing and coordinating of concurrent engineering activities such as risk assessment, logistics analysis quality assurance, safety analysis, reliability availability and maintainability analysis etc

1 5 2 Systems Engineering Functions

Systems engineering functions include a combination of technical and management processes applied throughout the life-cycle of a project. Systems engineering is the first activity undertaken when starting a new project. First, systems engineering develops requirements based on customer mission need, objectives and constraints. Secondly an optimized system configuration is developed and turned over to design engineering

During design engineering systems engineering personnel (a) conduct reviews of technical progress to ensure that the technical performance of the system will meet requirements, (b) evaluate life-cycle-cost (LCC) to ensure that costs are kept to a minimum, (c) evaluate proposed changes to baseline requirements and configurations, and (d) ensure that all relevant specialty engineering requirements are considered and that applicable features are integrated into the design.

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During procurement and construction, systems engineering activities include progress reviews continued evaluation of LCC and evaluation of proposed changes to baseline requirements and configurations Systems engineering activities during system testing and startup consist of reviewing progress monitoring technical performance and evaluating proposed changes to testing procedures

As an example applicable to ERM projects assume that a need has been identified to remediate an area where the soil is contaminated with a toxic substance and that a project is undertaken to meet this need. Systems engineering techniques are used to completely define the remedial action requirements through characterization carry out the evaluations needed to pick the best remediation method (i.e to treat, remove transport, and dispose of the contaminated soil) manage the activities to demonstrate that the selected approach meets the technical requirements, and estimate and evaluate the LCC of the chosen method. During design and construction systems engineering is used to evaluate proposed changes and monitor tests to ensure that the baseline system's technical performance is maintained.

1 5 3 System Engineering Process Phases

The seven phases of the systems engineering process advocated by DOE Order 4700 1 are depicted in Figure 1 1 It should be noted that the process provides for feedback from both design synthesis and system definition through evaluation and optimization. The feedback may result in changes to any of the preceding process results, including mission need and objectives definition and the development of design requirements The feedback allows an iteration process, which is helpful in arriving at optimum solutions A definition of each phase is given below

1 5 3 1 Mission Needs, Project Objectives, and Constraints- Mission needs project objectives and constraints constitute project top-level requirements. They are prepared by DOE/RFO and serve as the basic input to the systems engineering process. During the first phase, project mission needs objectives, and constraints (technical health and safety institutional, schedule costs etc) are defined, forming the basis for the designated project and allowing the systems engineering process to begin As the project proceeds into the next system engineering phase the results can be traced back to the top-level requirements established in the first phase

1.5.3 2 Function Analysis- Given the top level requirements (i e. defined need objectives and constraints) provided by DOE, three interrelated activities are initiated. (1) functional identification, (2) functional performance requirements analysis, and (3) time requirements analysis

1 5.3.2 1 Functional Identification Functions are identified to carry out the activities to meet the defined need. Functions are often identified through the use of functional flow block diagrams (FFBDs) that depict relationships among functions In Figure 1 1 each function is displayed by a block. Taken together the blocks show the sequential relationship of all functions of a system that meets the defined need. Some functions may be accomplished in parallel others must be performed in series In the diagram, these relationships are shown by lines connecting the blocks Functions identify what must be accomplished, not how it is to be done FFBDs can be developed on more than one level of detail As the FFBD is prepared, an understanding of the

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total operation of the system is acquired. Further the flow diagram can serve as a basis for developing operating procedures

For example if a defined need results in an OU remediation project for the removal and safe disposal of contaminated soil the necessary functions might be (a) identify the applicable regulations and standards, (b) characterize the nature and quantity of contaminated soil, (c) select a disposal site (d) select the means to remove package transport, and store the contaminated soil (e) identify the environmental controls to be used, (f) define the final monitoring plan to verify the acceptability of residual soil, and (g) define the monitoring plan at the disposal site

*1 5 3 2 2 **Functional Performance Requirements Analysis*** Inputs into and outputs from each function are identified and analyzed to better understand the interrelationships of all system functions These input/output interactions become the initial definition of interfaces between the system s functional elements For each function performance requirements are developed. These requirements are characteristics of the output (i e the percent of contamination to be removed, the removal capacity) as compared to the input. Performance requirements are developed in sufficient detail for direct use as criteria for design and operation personnel skill development, determination of environmental safety and health consideration and logistics support, etc

*1 5 3.2.3 **Time Requirement Analysis***--Time requirements are evaluated by examining the sequential occurrence of the functions The concurrence overlap and timing of the functions are used to identify time-critical functions -- those that affect reaction time, down time or availability This is useful in developing design requirements for some functions. Further the time relationship of all functions must be understood to ensure the effective use of resources For example if an acceptable disposal site is not available for several years many of the soil disposal activities can be delayed Some of the functions might be changed, or their sequences may be revised as the result of the time requirements analysis

1.5.3.3 Functional Allocation In this phase Requirement Allocation Sheets (RASs) are used for identifying and allocating function requirements from FFBDs to individual system elements such as subsystems or equipment. Normally a RAS is used to record the performance requirements for each function depicted on the FFBD During functional allocation, the RAS is often used for subfunctions rather than expanding the FFBD graphic Requirements are given in terms of (a) the purpose of the function, (b) performance parameters (c) design constraints, (d) special requirements for safety reliability etc and (e) interfaces. After a configuration has been selected, the RAS is used to allocate functional requirements to individual system elements. For example elements that constitute an acceptable characterization of contaminated soil are established (i e the number of samples how taken where taken how analyzed, and how reported would all be specified as performance requirements)

1.5.3 4 Design Synthesis and Integration Design synthesis is the creation of one or more design concepts to satisfy the stated requirements Integration brings together the design concept components to form a single entity or system. During this phase, candidate design concepts (i.e remedial action) are developed using the allocated system requirements developed in the preceding

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phase All system components are considered to arrive at an integrated system. As the details of the alternative systems are developed, all system requirements including interface requirements are considered.

For example in a contaminated soil removal and storage project, two or more soil removal methods are defined. These may include equipment and personnel containers for collecting transporting and storing the contaminated soil, routes and means for transporting the soil containers procedures for closing up and handling the containers, permanent disposal sites protection and monitoring and environmental monitoring with equipment and personnel etc Incorporation of a new feature to satisfy personnel safety may lead to change in another feature that had already been identified. Several alternatives to satisfy the change in requirements are identified, evaluated, and integrated into the concepts This synthesis and integration process continues until all requirements have been satisfied and the alternative systems are shown to be feasible

1 5.3 5 Analysis, Evaluation, and Optimization This iterative system activity starts as soon as system concepts begin to take shape Initial analyses are undertaken to determine design margins and assess alternatives. In this phase each alternative is analyzed for possible improvements Alternatives that have promise are evaluated in more detail. Although the alternative designs for a system are specifically created to meet the requirements developed from the defined need, it is possible that some changes would lead to improved systems. Analyses carried out are defined below

1 5 3.5 1 Tradeoff Studies--Appropriate tradeoff studies are conducted to postulate design alternatives to satisfy the functional performance requirements For example in a remedial project involving soil removal and disposal, a tradeoff study could be conducted on the effect of another disposal site or smaller soil containers

1 5.3 5.2 Cost Effectiveness Analysis -Cost-effectiveness analysis is conducted to ensure that engineering decisions resulting from the review of alternatives will be made only after considering their impact on effectiveness and cost. This includes operations, maintenance and disposition activities

1.5.3 5 3 Support Analysis--Support analysis is conducted to define logistics support needs (i.e maintenance transportation and handling equipment spares, repair parts, personnel technical orders and manuals, etc) In a remedial project involving soil removal and disposal, an example could be analyzing the impact of different types of transport vehicles

1 5.3 5 4 Risk Analysis--As the remedial action selection and/or design progresses a continuing analysis is conducted of the risk associated with the related cost, schedule and technical baselines This analysis identifies critical areas and investigates methods for minimizing risk, including prototypes testing and backup development. This analysis will also identify test requirements technical performance measurement parameters, and critical milestones

1 5 3 5.5 Operational Analysis--Reliability availability and maintainability LCC estimates and constructability/predictability tasks are performed to help clarify the requirements being documented and to define the project's operational needs The effects of any change on the

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entire system must be determined to maintain a well integrated system configuration. As the results of these evaluations are considered, some changes will be recommended for inclusion in the optimized system

1.5.3 6 System Definition In this phase the performance configuration and arrangement of a chosen solution/system and its elements are portrayed in suitable forms Suitable forms may include diagrams layouts computer or physical models procedures and schedules etc Physical and functional interfaces between system elements are described, as are system performance characteristics Designs for equipment and facilities are comprehensive enough to permit detailed assessment. The solution selected may not be optimum, but it must be acceptable

In a typical ER project, the system definition phase starts when an acceptable solution is selected and submitted for EPA approval during the CERCLA Record of Decision (ROD) process After obtaining approvals RD activities are started by producing detailed drawings, specifications and procedures that completely define the system configuration Test procedures are prepared as needed

1.5.3 7 Construction and Integrated System Testing This phase of the systems engineering process as applied to ER projects, consists of constructing equipment and facilities and implementing system tests during fabrication/procurement and construction of new equipment and facilities as applicable

Tests are performed in accordance with test plans Fabrication and construction are performed in conformance with the drawings and specifications System tests, as needed, follow the prepared test procedures to verify that performance is acceptable When satisfactorily completed, the system is declared ready Finally the RA is implemented.

For a contaminated soil removal and storage project, any special equipment (i e soil container) will be fabricated, then tested to confirm conformance to requirements. Environmental monitoring equipment is selected, and procedures are finalized for soil removal container loading, and environmental monitoring Any required facilities are constructed and then tested for acceptability When system performance is acceptable work will begin and continue to completion.

1 5 4 Program Baseline

DOE Order 4700 1 defines a baseline as a quantitative expression of projected costs, schedule or technical progress to serve as a base or standard for performance of a effort. The project baseline is needed for project execution, control, decision making and reporting It provides the criteria against which project progress is measured and is a traceable record of the site assessment, remediation design and cleanup process

The project baseline consists of a set of controlled information that has been placed or will be placed under configuration management (i e change control, tracking, verification, and reporting) Baseline definitions are described in Section 3 1 of the Configuration Management Plan (CMP)

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2 0 Technical Planning and Control

Technical planning and control for the EG&G ERM Program are delineated below for the various program activities The EG&G ERM Program Manager will ensure that systems engineering activities are carried out according to this plan Systems engineering tasks will be performed by the EG&G ERM Program personnel Application and responsibilities for systems engineering and integration activities are shown in Figure 2 1 However responsibility and authority to carry out systems engineering tasks will be designated as appropriate by the EG&G ERM Program Manager

2 1 PLANNING

Technical objectives for the EG&G ERM Program are described in the DOE/RFO Program Management Plan (PMP) These objectives will be used to integrate the ERM activities by establishing relationships among program needs priorities risks, and added value for work performed.

Technical reviews and control of documentation will guide development of integration plans and schedules for the program. The EG&G ERM Program objectives will be reviewed to ensure that the remedial schedules are realistic Technical reviews will be the responsibility of the Director of Environmental Services and Engineering (ES&S) or his designee

Coordination and planning between remediation specialists and engineering design disciplines and specialties will be provided early in the assessment phase for OUs

2 2 DESIGN CONCEPTS

Design concept requirements will be implemented on activities related to remedial options evaluation/selection (i.e during FS and IA planning) and RD

2 2 1 Completeness

Remediation alternatives will be selected to include the overall mission given in the PMP the priority required for the remediation, schedule and budget constraints, and available resources including support facilities utilities hardware software personnel, and procedures. Remediation alternatives will be reviewed to ensure that the remedial schedules are realistic

2 2 2 Interface Compatibility

In the process of developing remedial concepts requirements regarding design compatibility of engineering interfaces will be define as appropriate in IA Plans and Remedial Investigation/ Feasibility Study (RI/FS) Reports or supplementary documents The supplementary documents may include system requirements documents functional and operational requirements (F&OR) documents, conceptual design reports design criteria documents and detail design packages

Interface requirements related to major system elements, facilities, utilities, hardware, software and procedures will be established, coordinated, and maintained. Clear lines of communication and timely dissemination of changes to these interface documents will be maintained according to the ER Program Directives (PDs)

2 2 3 Simplicity

The IA plans and FS tasks will evaluate the most suitable options according to the CERCLA process Additional tasks may be undertaken by the EG&G ER Program to identify and assess available technologies well in advance of the FS and IA planning tasks. During the selection and development of remedial alternatives, the concept of design simplicity and maximum standardization will be employed (i e existing technology and standard off the shelf hardware items will be used whenever requirements and analyses permit)

2 3 TECHNICAL DESIGN REQUIREMENTS DEFINITION

Technical design requirements definitions will be applicable to activities related to remedial options evaluation/selection (i.e during FS and IA planning) and RD

2 3 1 Baseline Identification

Technical baselines will be established for each OU Technical plans and work statements for assessment of the OUs will be developed according to the CERCLA IAG or CDH requirements These plans will be made a part of the program baseline. The technical baselines contain the ER program s technical requirements, and form the basis for the cost and schedule baselines

2 3 2 Traceability

TBD will be used to describe the manner in which the system design requirements are traceable to the top-level requirements

2 4 CONTROLS

Controls will be implemented on activities related to remedial options evaluation/selection (e g during FS and LA planning) and the RD phase of an IA site

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2 4 1 CWBS Compatibility

The CWBS divides the work to be performed into major task areas CWBS compatibility with technical tasks ensures that technical control of the remediation activities is integrated with funds, cost, schedule and performance controls System and technical requirements will also be consistent and traceable throughout the CWBS This consistency will permit prompt assessment of changes in the requirements and help determine impact on the program cost, schedule, technical problems and performance

2 4 2 Technology Risk Assessment

Remedial action implementation risks (i e technical safety and health, institutional, cost, and schedule) will be qualitatively or quantitatively assessed, as appropriate, to guide engineering decisions and evaluation of alternative schemes

2 4 3 Technical Performance Measurement

Technical performance measurement techniques given in the PDs will be used to compare the actual technical achievement against the technical baseline This includes identification of the differences between the technical achievement to date and the technical baseline, with any new problems and risk areas reported to program management. Technical performance measurement will be a vital tool in achieving conformance to outside agency regulations Technical performance measurement is similar to cost and schedule performance measurement and is a part of the Performance Measurement Baseline developed in the PMP

2 4 4 Compatibility with Related Activities

Systems engineering management activities will be compatible with related program management activities For example changes to system requirements in response to a solution to an identified problem will be evaluated for total project impact with respect to performance cost, and schedule as discussed in the CMP

2 5 ANALYSIS

An analysis will be performed during remedial options evaluation/selection and RD Remediation decisions regarding options will reflect analysis of system cost-effectiveness based on performance and other technical parameters, as provided in the EPA guidance documents (See Reference 2) To the extent allowed by CERCLA the analysis will consider risk calculations and LCC factors

Before selecting a remediation approach, what if' exercises will be conducted to determine the effectiveness of the proposed remediation approach Also the analysis will address project schedule and resource constraints Remediation decisions will be traceable to the analyses upon which they were based.

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Cost-effectiveness analysis of engineering alternatives will include cost of acquisition and ownership including maintaining regulatory compliance

Cost estimating plan guidelines have been developed to integrate cost estimates life-cycle planning and independent cost estimate reviews

2 6 TECHNICAL REVIEWS

Technical reviews will cover all aspects of the activities requiring RI/FS RD or RA efforts under the IAG as well as D&D sites Technical documents generated will be reviewed according to procedures to ensure that all remediation requirements have been met. All reviews will include a regulatory component as required by the IAG In process reviews will be used to the extent possible

Technical reviews will be used to assess the degree of compliance of each task with the applicable baseline mission and remediation requirements Technical reviews will provide a systematic documented approach for ensuring that scheduled activities have been accomplished in conformance to the technical requirements. The review process will accomplish the following goals

Establish authorization to proceed with the next increment of work,
Establish an updated technical baseline to be used by project participants
Ensure that technical activities meet the approved technical requirements
Identify technical deficiencies as early as possible,
Ensure that all interfaces are adequately defined, and
Identify corrective action

2 6 1 Independent Verification

Documents requiring submittal under the IAG IA plans RI/FS scoping/plans, and RI/FS reports will receive independent verification as directed by DOE/RFO Independent "in process reviews will be used to the extent possible

2 6 2 Review of Subcontractor Technical Efforts

Review of subcontractor and vendor technical efforts will be conducted as appropriate or required. Laboratory analysis data will be reviewed according to EPA guidelines on data validation. A complete description of the data review/data validation process can be found in the GRAASP plan. Review requirements will be established for any subcontractor or vendor providing services in support of the EG&G ERM tasks involving IA RI/FS RD or RA activities

2 6 3 Public Reviews

Public review of the ER Program activities will be arranged by the DOE/RFO as required.

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2 7 CORRECTIVE ACTION IMPLEMENTATION AND CONTROL

Technical problems and other discrepancies including noncompliance with remediation requirements can be identified at any phase of the remediation process Once identified, discrepancies will be formally documented as action items assigned to a responsible party for closure and tracked until closed. Corrective actions will be implemented and will be tailored to be responsive to specific program needs

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3 0 SYSTEMS ENGINEERING PROCESS

The systems engineering process will be integrated with the CERCLA RI/FS process to eliminate duplication of efforts The CERCLA phases (as provided in the IAG and as further defined in the EPA guidelines) and the applicable systems engineering activities expected to be most dominant in each phase are discussed below

3 1 MISSION NEEDS, OBJECTIVES, AND CONSTRAINTS

The mission needs, objectives and constraints for the RFO ERM Program are defined in PMP All of the EG&G ERM Program technical activities will be traceable to and conducted for the purpose of satisfying these top-level requirements

3 2 SITE CHARACTERIZATION/INVESTIGATION

The EG&G ERM Program site characterization/investigation efforts will include scoping assessment, RIs, and Decontamination and Decommissioning (D&D) characterizations

Before characterization/investigation, plans will be prepared in compliance with the IAG CERCLA, RCRA, Consent Order and Compliance Agreement (COCA) and/or DOE Orders to identify requirements and describe the methodology for characterization/investigation. Systems engineering during CERCLA characterization/investigation will be performed by adhering to the Data Quality Objective (DQO) process per EPA guidelines The DQO process will ensure complete well integrated, and focused requirements for site characterization/investigation These requirements will be a part of the characterization/investigation plan and become baseline requirements when approved.

3 3 REMEDIAL ALTERNATIVES SELECTION

3 3 1 Pre CERCLA Remedial Alternatives Selection

As appropriate systems engineering tools will be applied during pre RI/FS activities to ensure that a limited set of cost-effective options are available for consideration during the CERCLA remedial selection process

Based on the top-level requirements systems engineering function analysis and functional allocation will be used to define several remediation system concepts. Then the candidate system concepts will be analyzed by the systems engineering functions of design synthesis, integration, and concept exploration. Analysis will include tradeoff studies and evaluation and optimization to compare the alternatives before selecting a set of preferred system concepts These efforts will ensure selection of a limited set of concepts which are optimized to meet all requirements at a minimum cost.

The requirements that define the system will be documented according to the format given in DOE Standard NE F 1 2T Preparation of Plant and System Design

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Description Documents January 1989 A section of this document will provide the justification and source of each requirement with its traceability to higher level requirements Interface requirements and system input/output requirements will also be included This document will become a project baseline when approved.

3 3 2 CERCLA Remedial Alternatives Selection

Selection of the remediation approach for all IA cleanups is documented in an IA Plan. Similarly selection of the remediation approach for all post RI/FS cleanups is documented in a FS report. Selection of a remediation approach for either an IA or post RI/FS cleanup will be performed according to the option analysis and evaluation process in the EPA guidelines. The EPA recommended process is designed to ensure that the selected remedial approach will fulfill the top-level requirements This is comparable to the systems engineering process advocated in DOE Order 4700 1

3 4 REMEDIAL DESIGN AND REMEDIAL ACTION

EG&G will have RD and RA responsibilities during IA activities. Also, EG&G will have monitoring responsibilities as an operating contractor on projects that involve RD and RA being performed by other contractors selected by DOE/RFO The systems engineering process applied to RD and RA may include systems definition and support of construction integrated testing activities as defined in the is plan (Subsections 1 5 2 1 5 3 6 and 1 5 3 7) Internal memoranda or other documents will be used to establish the level and scope of systems engineering activities at the beginning of each RD and RA task performed by EG&G or RD and RA tasks for which EG&G will have monitoring responsibility

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4 0 ENGINEERING SPECIALTY INTEGRATION

Engineering specialty integration will be performed during the EG&G ERM Program activities involving alternatives selection RD and RA Coordination of engineering specialties (i e reliability availability maintainability safety engineering human factors analysis interface control LCC estimating and requirements documentation) will be accomplished through memoranda and presentations in project meetings documented by meeting minutes

4 1 INTERFACES

Interfaces will be integrated into the design concepts and verified through design reviews Systems engineering will ensure that all interfaces are identified and considered to the extent that the system and its subsystems or components must be identified in the conceptual designs

4 2 ENVIRONMENTAL, SAFETY, AND HEALTH

Systems engineering will be used to ensure that all aspects of the project related to environmental safety and health (i.e environmental evaluation reports, safety analysis reports safety reviews safety audits and other safety and health related actions) are identified and considered. This will be accomplished by integrating and coordinating all environmental and safety related tasks with safety personnel through systems engineering

4 3 RISK MANAGEMENT

Risk management ensures that risk analyses are preformed and used by the ERM Program management as a decision making tool The risk analyses performed and the mitigation actions planned will be documented. Risk mitigation actions will be tracked and reported by CWBS element or on a task by task basis

4 4 RELIABILITY, AVAILABILITY, AND MAINTAINABILITY

As appropriate during all ERM remediation system concept exploration activities, reliability availability and maintainability studies will be used to ensure that viable solutions to meeting the project s objectives are selected.

4 5 SYSTEM TESTING

A plan will be prepare to delineate requirements for treatability studies conducted by the EG&G ERM Program.

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5 0 REFERENCES

1) *RFP Federal Facility Agreement and Consent Order* (called the Interagency Agreement, or *IAG) and Action* Plan

2) EPA/540/g 89/004 *Guidance for Conducting Remedial Investigations and Feasibility Studies Under* CERCLA

3) DOE Order 4700 1 *Project Management System*

4) ER/ORP 100 *Environmental Restoration Program On Site Remediation Program Management Plan Interim Final Draft*

5) ERD1-012 91 Integrating *CERCLA and NEPA Requirements for Environmental Restoration* at RFP

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Appendix A – Acronym List

CAP	Cost Account Plan
CDH	Colorado Department of Health
CERCLA	Comprehensive Environmental Response Compensation, and Liability Act
CMP	Configuration Management Plan
COCA	Consent Order and Compliance Agreement
CWBS	Contract Work Breakdown Structure
D&D	Decontamination and Decommissioning
DOE	Department of Energy
DOE/HQ	Department of Energy/Headquarters (Washington D C)
DOE/RFO	Department of Energy/Rocky Flats Office
DQO	Data Quality Objective
EPA	Environmental Protection Agency
ERM	Environmental Restoration Management
ES&E	Environmental Science and Engineering
F&OR	Functional and Operational Requirements
FFBD	Functional Flow Block Diagrams
IA	Interim Action
IAG	Interagency Agreement
IWCP	Integrated Work Control Package
LCC	Life-Cycle Cost
NEPA	National Environmental Policy Act
OU	Operable Unit
PD	Program Directive
PMP	Program Management Plan

RA	Remedial Action
RAS	Requirement Allocation Sheets
RD	Remedial Design
RFP	Rocky Flats Plant
RI/FS	Remedial Investigation/Feasibility Study
ROD	Record of Decision
SEMP	Systems Engineering Management Plan
T&EP	Test and Evaluation Plan
TS&I	Technical Support and Integration
USTs	Underground Storage Tanks

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